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# Rudimentary Force Feedback for Safe Guarded Teleoperation of Unmanned Vehicles: A Simulations and Training Approach

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SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

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# Briefing Agenda

SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

- Guarded Teleoperation Concepts
- Current Research
  - Objectives
  - Simulation Environments
  - Example Application
- Future Collaboration
- Conclusion

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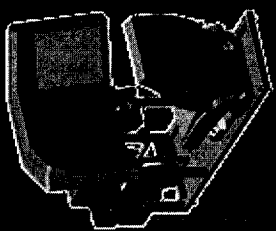
# Guarded Teleoperation Concepts

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- Enhancing soldier situational awareness through feedback from unmanned vehicles
- Mitigating risks of Teleoperation
- Mitigating risks of Indirect Vision Driving
- Use of multi-modal interfaces; visual, audio, tactile (haptics)

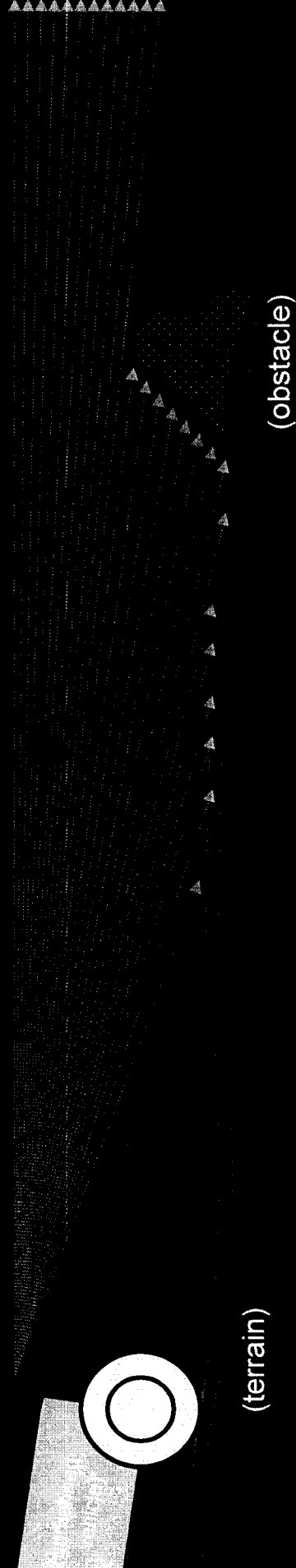
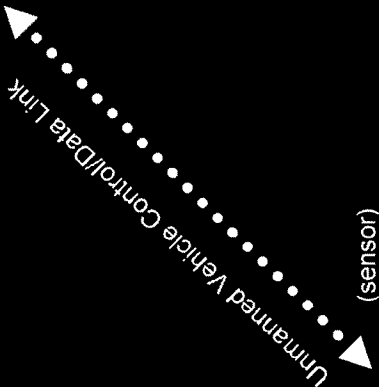
# Guarded Teleoperation Concepts (cont.)

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Human-in-the-Loop  
UV Control Station

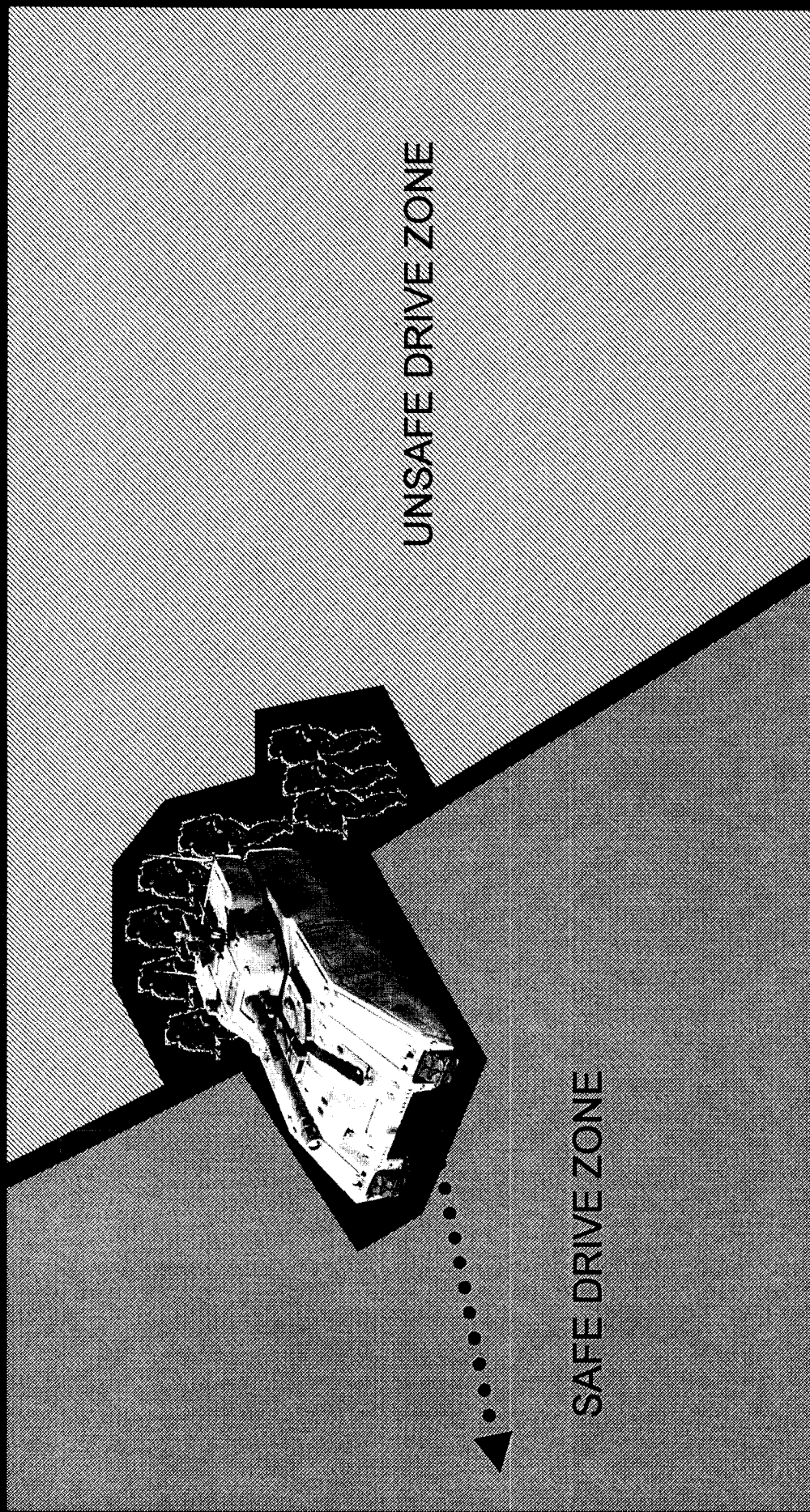
- Use of haptic displays to guide unmanned vehicles
- Feedback allows human to sense proximity of obstacles and take corrective measure and/or replan route to continue mission
- Mitigates risks



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# Indirect Vision Driving (IVD) Safety

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# Survivability Applications

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INCOMING THREAT DETECTION



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# In-house Research Objectives

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- To generate initial capability to develop and test guarded teleoperation and IVD safety concepts
- To support current research activities in the areas applicable to Human Robotics Interface (HRI)
  - Use of multi-modal interfaces?
  - Why haptics? Are there better or more efficient methods to present this data?





# Simulation Environments

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- Initial capabilities using game engine / low-fidelity model representation platforms
- Delta3D
  - OpenSceneGraph/OpenDynamicsEngine
  - OpenFlight terrain database
  - Simulated sensor capability
  - DirectX for interfacing to Haptics devices



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## Example Application

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Human Interface Device Demo1

Y: 1736

**SAFE**

Reset All Sensors

Trip All Sensors

Test Feedback

Quit

X: 250

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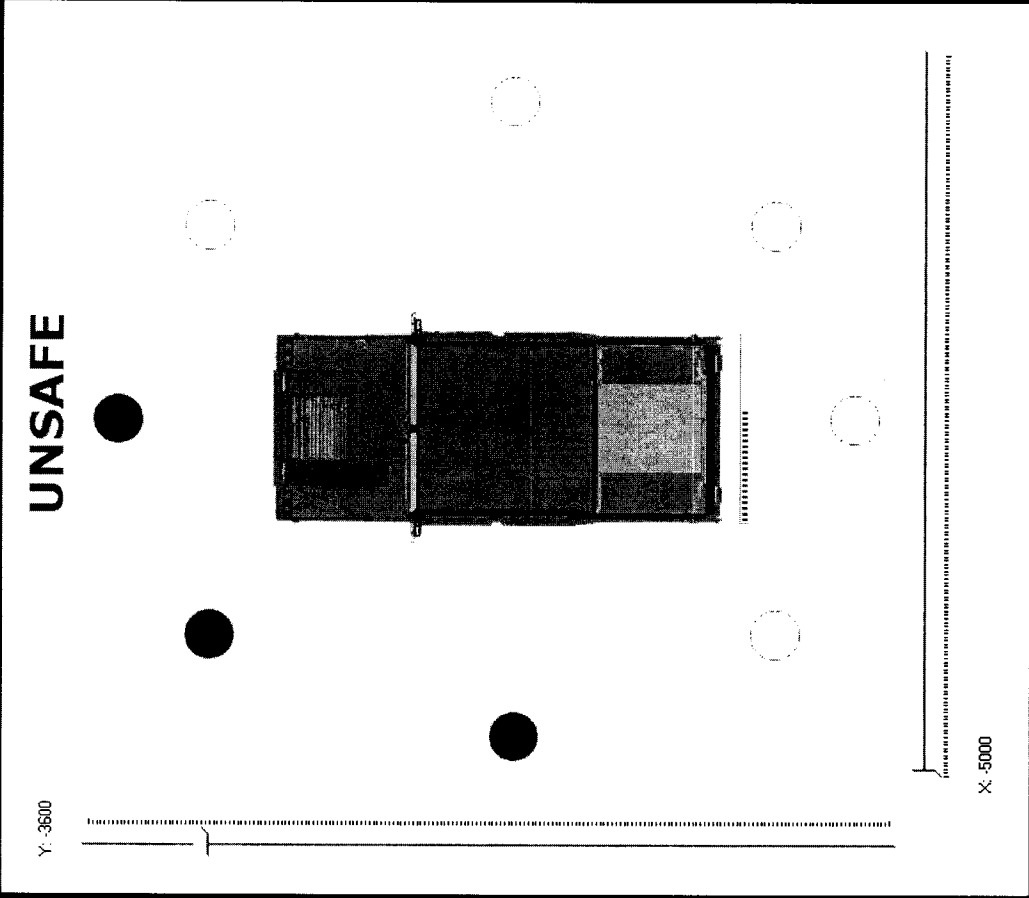
# Example Application (continued)

SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

Human Interface Device Demo1

Y: -3600

UNSAFE



X: -5000

Reset All Sensors

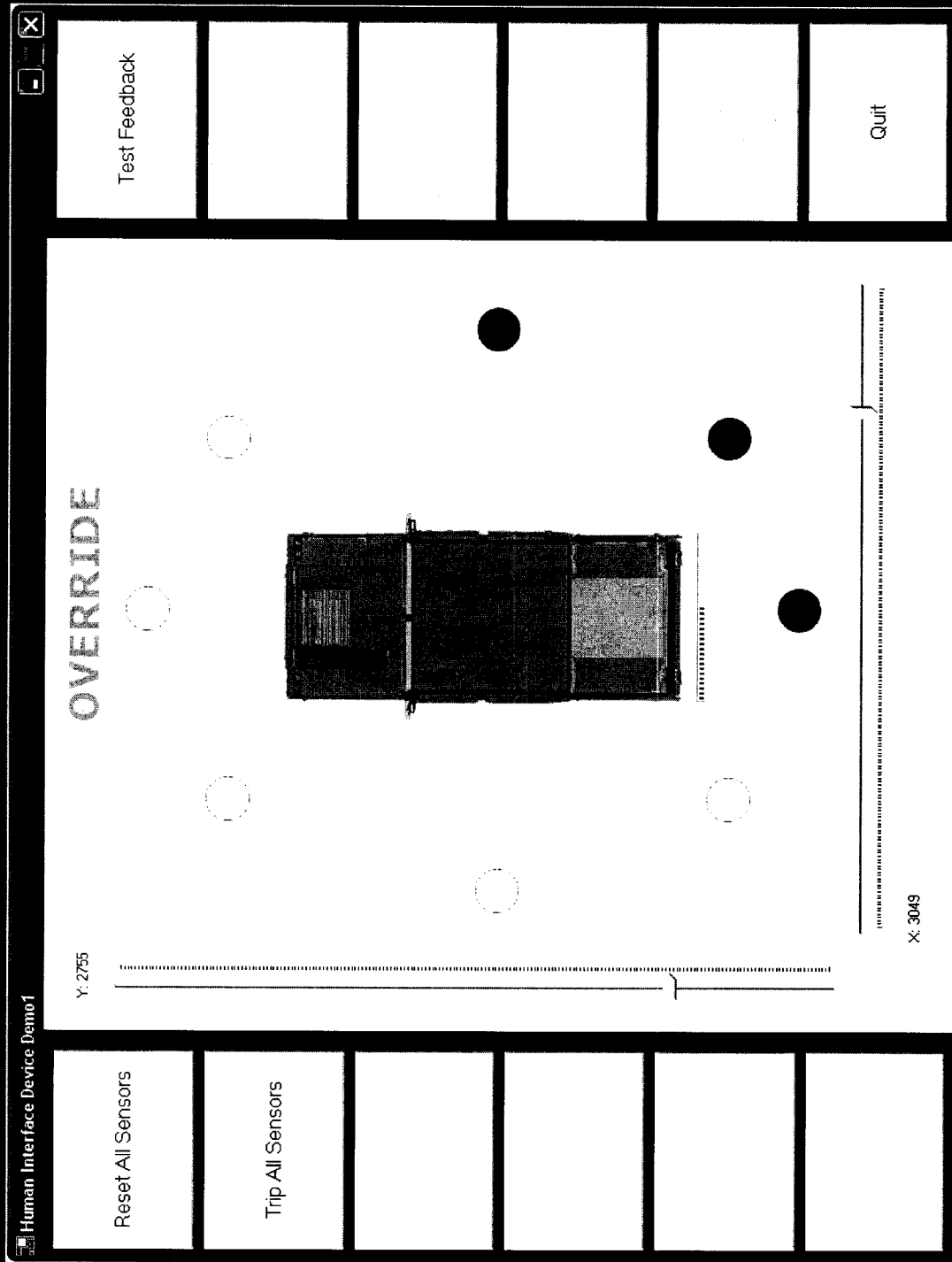
Trip All Sensors

Test Feedback

Quit

# Example Application (continued)

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# Example Application (continued)

SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

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image generator



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## Future Collaboration

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- Better integration with existing human-in-the-loop hardware
- Review of commercially available haptics devices (vests, belts, straps, etc.)
- Implementation of generic drivers to allow hardware usage from various computing platforms

## Conclusion

SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

- Continued in-house research in areas of safe teleoperation pertinent to FCS objectives
- Looking for program partnerships for concepts demonstrations and testing

## *Questions?*